

Chapter - Motion

Motion :- An object is said to be in motion if its position changes continuously with respect to a fixed observer or reference point.

Note :- Motion is relative in nature.

Vector Quantities :- Those physical quantities are described by magnitude as well as direction, is called vector quantities.

Ex - Displacement, velocity, acceleration etc.

Scalar Quantities :- Those physical quantities are described by only magnitude, are called scalar quantities.

Ex - Work, energy, distance etc.

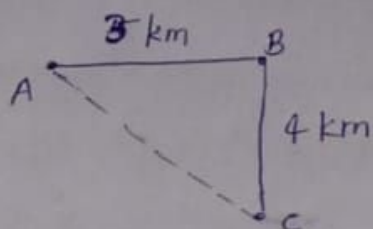
Distance :- The actual length of path covered by a body during the course of motion from initial position to the final position.

Displacement :- Displacement is defined as the shortest distance between initial and final position of an object.

Note:- (i) The relation between distance & displacement  
Displacement  $\leq$  Distance

$$\Rightarrow \boxed{\frac{\text{Distance}}{\text{Displacement}} \leq 1}$$

(ii) Ex-



$$\text{Total distance} = 3 + 4 = 7 \text{ km}$$

$$\text{But Displacement} = \sqrt{3^2 + 4^2} = \sqrt{25} = 5 \text{ km}$$

- Uniform Motion:- An object is said to be possess uniform motion if it travels equal distance in given equal interval of time.
- Non-uniform motion:- A body is said to be in non-uniform motion if it covers unequal distance in equal time interval.
- Speed:- Speed is defined as the distance travelled by a body per unit time.

$$\boxed{(s) \text{ Speed} = \frac{\text{Distance travelled (d)}}{\text{Time Taken (t)}}$$

$$\Rightarrow \boxed{s = \frac{d}{t}}$$

Note:- Speed is a scalar quantity.

- Instantaneous speed:- The speed of an object at instant or moment of time.
- Average Speed:- Average speed is defined as the ratio of total distance travelled by a body over a journey to the total time taken by the body.

$$\text{Average Speed} = \frac{\text{Total distance travelled}}{\text{Total time taken}}$$

unit = meter/Second

Uniform Speed:- A body moving in uniform motion has uniform speed.

Non-uniform Speed:- A body moving in non-uniform motion has non-uniform speed.

Note:- (i)  $1 \text{ m/sec} = \frac{18}{5} \text{ km/h}$

(ii)  $1 \text{ km/h} = \frac{5}{18} \text{ m/sec}$ .



Velocity :- Velocity is defined as the displacement of a body per unit time.

$$\text{Velocity} = \frac{\text{Displacement}}{\text{Time taken}} \rightarrow v = \frac{d}{t}$$

Uniform Velocity :- A body is said to have ~~non~~ uniform velocity, if it moves along a straight line path at constant speed.

Non-uniform velocity :- A body is said to have non-uniform velocity if its speed or direction changes with time.

Average Velocity :- It is defined as the ratio of its total displacement to the total time taken by it to cover this displacement.

$$\text{Average velocity} = \frac{\text{Total displacement}}{\text{Total time taken}}$$

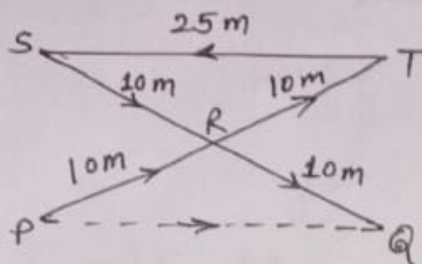
$$v_{\text{avg}} = \frac{d}{t}$$

where  $d$  = displacement  
 $t$  = time taken

## Questions

Que ① A girl swims along the length of 80m in swimming pool and comes back in 105 seconds. Find her distance covered and displacement.

Que ② A body moves from point P to Q as shown in figure. Find its distance and displacement



Que ③ Convert a speed of 108 km/h into m/sec

Que ④ A bus travels a distance of 120 km with a speed of 40 km/h and returns with a speed of 30 km/h. Calculate its average speed for the journey.

Que ⑤ A body moves along the edge of a square park of side 40m and stops at the diagonally opposite end of it. Find his velocity if he takes 0.5 minutes to reach there.

Que ⑥ Give the SI unit of speed.

Que ⑦ Compare the following speeds and arrange them in increasing order of their magnitude:-

- (i) a car running at 90 km/h, a bus moving at 20 m/s, a cycle covering 600 cm in 2 Sec.